

## APPENDIX C

### List of TRIM.Expo Input Parameters

**Table C-1<sup>1</sup>**  
**Example Input Parameters for Calculating Inhalation Exposures**

Parameter by Category	Units	Distribution Type	Reference/Source
<b>Building Parameters (for use in mass balance model)</b>			
Air exchange rates (ACH), residences – windows closed	1/time	Lognormal	Murray and Burmaster 1995
ACH, residences – windows open	1/time	Lognormal	Johnson et al. 1998
ACH, non-residential, enclosed microenvironments, filtered air	1/time		
ACH, non-residential, enclosed microenvironments, unfiltered air	1/time		
Efficiency of air cleaning device (F)	dimensionless fraction		
Flow rate through air cleaning device (q)	volume/time		
Fraction of outdoor pollutant intercepted by enclosure ( $F_B$ )	dimensionless fraction		
Indoor generation rate (S)	mass/time		
Indoor building volume (V)	volume		
Mixing factor (m)	dimensionless		
Pollutant decay coefficient ( $F_d$ )	1/time		
<b>Demographic Parameters</b>			
Age			Census data, Comprehensive Human Activity Database (CHAD)
Gender			Census data, Comprehensive Human Activity Database (CHAD)

<sup>1</sup> The input parameters and distribution types reflect the current initial choices that EPA is planning on using in developing the initial TRIM.Expo inhalation Prototype and are subject to change.

APPENDIX C  
LIST OF TRIM.EXPO INPUT PARAMETERS

Parameter by Category	Units	Distribution Type	Reference/Source
<b>Environmental Parameters</b>			
Temperature	degrees		National Climatic Data Center
<b>Physiological Parameters (for calculating ventilation rate)</b>			
Body mass (BM)	kilograms (kg)		Brainard and Burmaster 1992, Burmaster and Crouch 1997
Metabolic equivalence (MET)	dimensionless		
Oxygen uptake rate (VO <sub>2</sub> )	liters/min		Åstrand 1960, Mercier et al. 1991, Katch and Park 1975, Heil et al. 1995, Mermier et al. 1993, Rowland et al. 1987
Normalized oxygen uptake rate (NVO <sub>2</sub> )	ml/min/kg		Åstrand 1960, Mercier et al. 1991, Katch and Park 1975, Heil et al. 1995, Mermier et al. 1993, Rowland et al. 1987
Resting metabolic rate (RMR)	kcal/min	From regression fit specific to age and gender	Schofield 1985
<b>Pollutant Parameters</b>			
Ambient pollutant concentrations	mass/volume		Aerometric Information Retrieval System (AIRS), dispersion model, TRIM.FaTE
Microenvironmental concentrations	mass/volume		Mass balance model, direct measurement, intermedia transfer factors

**Table C-2<sup>2</sup>**  
**Example Input Parameters for Calculating Ingestion Exposures**

Parameter by Category	Units	Distribution Type	Reference/Source
<b>Demographic Parameters</b>			
Age			Census data, Comprehensive Human Activity Database (CHAD)
Gender			Census data, Comprehensive Human Activity Database (CHAD)
Body mass (BM)	kg		Brainard and Burmaster 1992, Burmaster and Crouch 1997
<b>Parameters Specific to Ground Water and Surface Water Intake</b>			
Concentration in tap water ( $C_{tw}$ )	mg/L		
Concentration in ground water or surface water ( $C_{gw/sw}$ )	mg/L		
Exposure duration (ED)	time		
Exposure frequency ( $EF_{z,tw}$ )	d/month (or equivalent)		
Rate of intake of tap water ( $I_{z,tw}$ )	L/kg/d		EPA Exposure Factors Handbook 1997b, Ershow and Cantor 1989, Canadian Ministry of Health and Welfare 1981
<b>Parameters Specific to Soil (Outdoors) Intake</b>			
Pollutant concentration in surface soil ( $C_{ss}$ )	mg/kg		
Exposure frequency ( $EF_{z,ss}$ )	d/month (or equivalent)		
Annually averaged daily rate of intake of soil ( $I_{z,ss}$ )	kg/kg/d		
<b>Parameters Specific to Dust (Indoors) Intake</b>			
Pollutant concentration in house dust [ $C_{hd}(i,t)$ ] ( <i>for exposure district, i, during time step t</i> )	mg/kg		
Pollutant concentration in surface soil [ $C_{ss}(i,t)$ ]	mg/kg		
Pollutant concentration of air particles [ $C_{ap}(i,t)$ ]	mg/m <sup>3</sup>		
Exposure frequency ( $EF_{z,hd}$ )	d/month (or equivalent)		
Annually averaged daily rate of intake of soil ( $I_{z,ss}$ )	kg/kg/d		
Fraction of indoor dust that originates from outdoor soil ( $f_{hds}$ )	dimensionless		

<sup>2</sup> The input parameters and distribution types reflect the current initial choices that EPA is planning on using in developing the initial TRIM.Expo ingestion Prototype and are subject to change.

Parameter by Category	Units	Distribution Type	Reference/Source
<b>Parameters Specific to Home-grown Vegetables, Fruits, and Grains Intake</b>			
Pollutant concentration – air [C <sub>a</sub> (i,t)]	mg/m <sup>3</sup>		
Pollutant concentration in root zone soil (C <sub>rs</sub> )	mg/kg		
Pollutant concentration in: 1) grains [C <sub>g</sub> (i,t)], 2) exposed fruits and vegetables [C <sub>efv</sub> (i,t)], 3) protected fruits and vegetables [C <sub>pfv</sub> (i,t)]	mg/kg		
Exposure frequency (number of days per month equivalent, that individual z consumes homegrown foods in exposure district in): 1) grains [EF <sub>z,g</sub> (i,t)], 2) exposed fruits and vegetables [EF <sub>z,efv</sub> (i,t)], 3) protected fruits and vegetables [EF <sub>z,pfv</sub> (i,t)]	d/month (or equivalent)		
Annually averaged daily rate of intake of grains (I <sub>z,g</sub> )	kg/kg/d		
Annually averaged daily rate of intake of exposed fruits and vegetables (I <sub>z,efg</sub> )	kg/kg/d		
Annually averaged daily rate of intake of protected fruits and vegetables (I <sub>z,pfg</sub> )	kg/kg/d		
<b>Parameters Specific to Home-grown Dairy Product Intake</b>			
Pollutant concentration in dairy products of exposure district, i at time step, t [C <sub>k</sub> (i,t)]	mg/kg		
Pollutant concentration in pasture [C <sub>p</sub> (i,t)]	mg/kg		
Pollutant concentration in surface soil [C <sub>s</sub> (i,t)]	mg/kg		
Pollutant concentration in the water [C <sub>w</sub> (i,t)]	mg/kg		
Biotransfer factor from cattle diet to dairy products [C <sub>k</sub> (i,t)/I <sub>ndc</sub> ]	d/kg		
Exposure frequency [EF <sub>z,k</sub> (i,t)]	d/month (or equivalent)		
Annually averaged daily rate of intake of dairy products (I <sub>z,k</sub> )	kg/kg/d		
Ingestion rate of pasture by dairy cattle (I <sub>pdc</sub> )	kg/d		
Ingestion rate of soil by dairy cattle (I <sub>sdc</sub> )	kg/d		

Parameter by Category	Units	Distribution Type	Reference/Source
Ingestion rate of water by dairy cattle ( $I_{w_{dc}}$ )	kg/d		
<b>Parameters Specific to Home-grown Egg Intake</b>			
Pollutant concentration of exposure district i, at time step, t [ $C_e(i,t)$ ]	mg/kg		
Pollutant concentration in pasture [ $C_p(i,t)$ ]	mg/kg		
Pollutant concentration in surface soil [ $C_s(i,t)$ ]	mg/kg		
Pollutant concentration in the water [ $C_w(i,t)$ ]	mg/kg		
Biotransfer factor from hen diet to eggs [ $C_e(i,t)/I_{hn}$ ]	d/kg		
Exposure frequency [ $EF_{z,e}(i,t)$ ]	d/month (or equivalent)		
Annually averaged daily rate of intake of eggs ( $I_{z,e}$ )	kg/kg/d		
Ingestion rate of pasture by chickens ( $I_{p_{hn}}$ )	kg/d		
Ingestion rate of soil by chickens ( $I_{s_{hn}}$ )	kg/d		
Ingestion rate of water by chickens ( $I_{w_{dc}}$ )	kg/d		
<b>Parameters Specific to Home-grown Meat and Poultry Intake</b>			
Pollutant concentration of exposure district, i at time step, t [ $C_k(i,t)$ ]	mg/kg		
Pollutant concentration in pasture [ $C_p(i,t)$ ]	mg/kg		
Pollutant concentration in surface soil [ $C_s(i,t)$ ]	mg/kg		
Pollutant concentration in the water [ $C_w(i,t)$ ]	mg/kg		
Biotransfer factor from cattle diet to meat [ $C_t(i,t)/I_{bc}$ ]	d/kg		
Exposure frequency [ $EF_{z,k}(i,t)$ ]	d/month (or equivalent)		
Annually averaged daily rate of intake of meat ( $I_{z,t}$ )	kg/kg/d		
Ingestion rate of pasture by beef cattle ( $I_{p_{bc}}$ )	kg/d		
Ingestion rate of soil by beef cattle ( $I_{s_{bc}}$ )	kg/d		
Ingestion rate of water by beef cattle ( $I_{w_{bc}}$ )	kg/d		

Parameter by Category	Units	Distribution Type	Reference/Source
<b>Parameters Specific to Locally-grown Vegetables, Fruits, and Grains Intake<sup>3</sup></b>			
Spatially-averaged pollutant concentration – air [ $C_a(\text{avg}, t)$ ]	mg/m <sup>3</sup>		
Spatially-averaged pollutant concentration in: 1) grains [ $C_g(\text{avg}, t)$ ], 2) exposed fruits and vegetables [ $C_{efv}(\text{avg}, t)$ ], 3) protected fruits and vegetables [ $C_{pfv}(\text{avg}, t)$ ]	mg/kg		
Exposure frequency (number of days per month equivalent, that individual z consumes locally-produced foods in exposure district in): 1) grains [ $EF_{z,g}(i, t)$ ], 2) exposed fruits and vegetables [ $EF_{z,efv}(i, t)$ ], 3) protected fruits and vegetables [ $EF_{z,pfv}(i, t)$ ]	d/month (or equivalent)		
<b>Parameters Specific to Locally-grown Dairy Product Intake<sup>4</sup></b>			
Spatially-averaged pollutant concentration – in the pastures of all suburban and rural exposure districts where local dairy products are produced during the time step, t [ $C_p(\text{avg}, t)$ ]	mg/kg		
Exposure frequency (number of days per month equivalent, that individual z consumes locally-produced dairy products in exposure district in): [ $EF_{z,k}(i, t)$ ]	d/month (or equivalent)		
<b>Parameters Specific to Locally-grown Egg Intake<sup>5</sup></b>			
Spatially-averaged pollutant concentration – in the pastures of all suburban and rural exposure districts where local eggs are produced during the time step, t [ $C_p(\text{avg}, t)$ ].	mg/kg		

<sup>3</sup> The parameters used to calculate the intake of pollutants for locally-grown vegetables, fruits, and grains are the same as those for home-grown with the following replacements.

<sup>4</sup> The parameters used to calculate the intake of pollutants for locally-grown dairy products are the same as those for home-grown with the following replacements.

<sup>5</sup> The parameters used to calculate the intake of pollutants for locally-grown egg products are the same as those for home-grown with the following replacements.

Parameter by Category	Units	Distribution Type	Reference/Source
<i>Exposure frequency</i> (number of days per month equivalent, that individual z consumes locally-produced eggs in exposure district i): $[EF_{z,e}(i,t)]$	d/month (or equivalent)		
<b>Parameters Specific to Locally-grown Meat and Poultry Intake<sup>6</sup></b>			
<i>Spatially-averaged pollutant concentration</i> – in the pastures of all suburban and rural exposure districts where local meat products are produced during the time step, t $[C_p(aveg,t)]$	mg/kg		
<i>Exposure frequency</i> (number of days per month equivalent, that individual z consumes locally-produced meat products in exposure district i): $[EF_{z,l}(i,t)]$	d/month (or equivalent)		
<b>Parameters Specific to Local Fish Intake</b>			
<i>Spatially-averaged pollutant concentration</i> – in the water of all exposure districts in the air shed being considered during the time step, t $[C_r(aveg,t)]$	mg/L		
Biotransfer factor from water to fish (BCF)	L/kg		
<i>Exposure frequency</i> (number of days per month equivalent, that individual z, in exposure district i, consumes locally caught fish): $[EF_{z,k}(i,t)]$	d/month (or equivalent)		
Annually-averaged daily rate of intake of fish ( $I_{z,f}$ )	kg/kg/d		

<sup>6</sup> The parameters used to calculate the intake of pollutants for locally-grown meat and poultry products are the same as those for home-grown with the following replacements.

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Parameter by Category	Units	Distribution Type	Reference/Source
<b>Parameters Specific to Recreational Sport Meat (Hunting)</b>			
<i>Spatially-averaged pollutant concentration</i> – in the meat of game animals residing in the air shed being considered during the time step, t [ $C_{sm}(avg,t)$ ]	mg/kg		
Time step averaged daily rate of intake of sport meat ( $I_{z,sm}$ )	kg/kg/d		